# Tool for Mycelium Grain Spawn Production

**Isaac Peterson**

Advisor: Dr. **Mitchell Neilsen**

# What is mycelium grain spawn?

# Ok, but who cares?

**Oats Prices - Historical Annual Data**

| Year | Average Closing Price | Year Open | Year High | Year Low | Year Close | Annual % Change |
|---|---|---|---|---|---|---|
| 2023 | $3.6943 | $3.6525 | $3.8820 | $3.6250 | $3.7630 | 3.07% |
| 2022 | $5.3724 | $6.8075 | $8.0700 | $3.3300 | $3.6510 | -46.54% |

macrotrends.net

Roll over image to zoom in

100 Grams/4 oz of Blue Oyster Mushroom Spawn Mycelium to Grow Gourmet and Medicinal Mushrooms at Home or commercially - Use to Grow on Straw or Sawdust Blocks - G1 or G2 Spawn

Brand: BetterFungi

4.4 out of 5 stars 171 ratings

Best Deal

$18.95 ($4.74 / Ounce)

prime

FREE Returns

amazon.com

# Input (oats + water)

- Oats = $3.69 / bushel
- 1 Bushel oats ≈ 34 lbs.
- $3.69 / 34 ≈ $0.10 / lb.

- Water ≈ $0.01 / gallon
- Oxygen = free

# Output (colonized grain spawn)

- $4.74 / oz
- 16 oz = 1 lb.
- $4.74 * 16 = $75.84 / lb.

profit margin (*minus overhead*) = 99.86% (absurdly high)

# Scalability Problem #1 : *$O_2$ Supply*

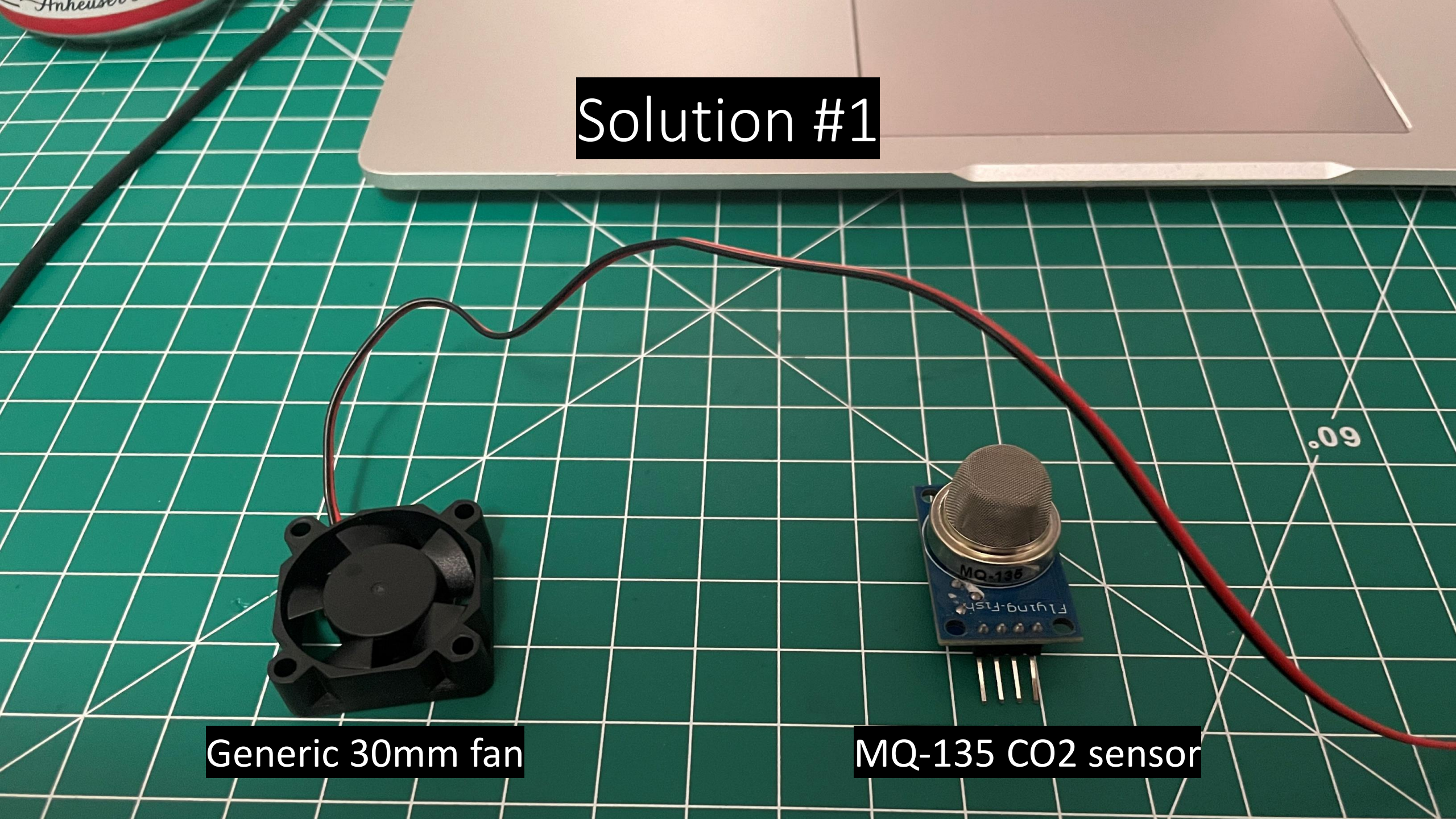
- aerobic respiration
- ≈ 29.37 L atmosphere / kg oats
- 66.6L (2.35 $ft^2$) for 5lb bags pictured
- Colonization rate bound by how much air happens to seep through a small hole

BOTTOM LINE:

≈ 8 weeks to colonize 5lb bags pictured


Autoclavable polypropylene grow bags with 0.2 µm filter port - northspore.com

# Solution #1




Generic 30mm fan

MQ-135 CO2 sensor

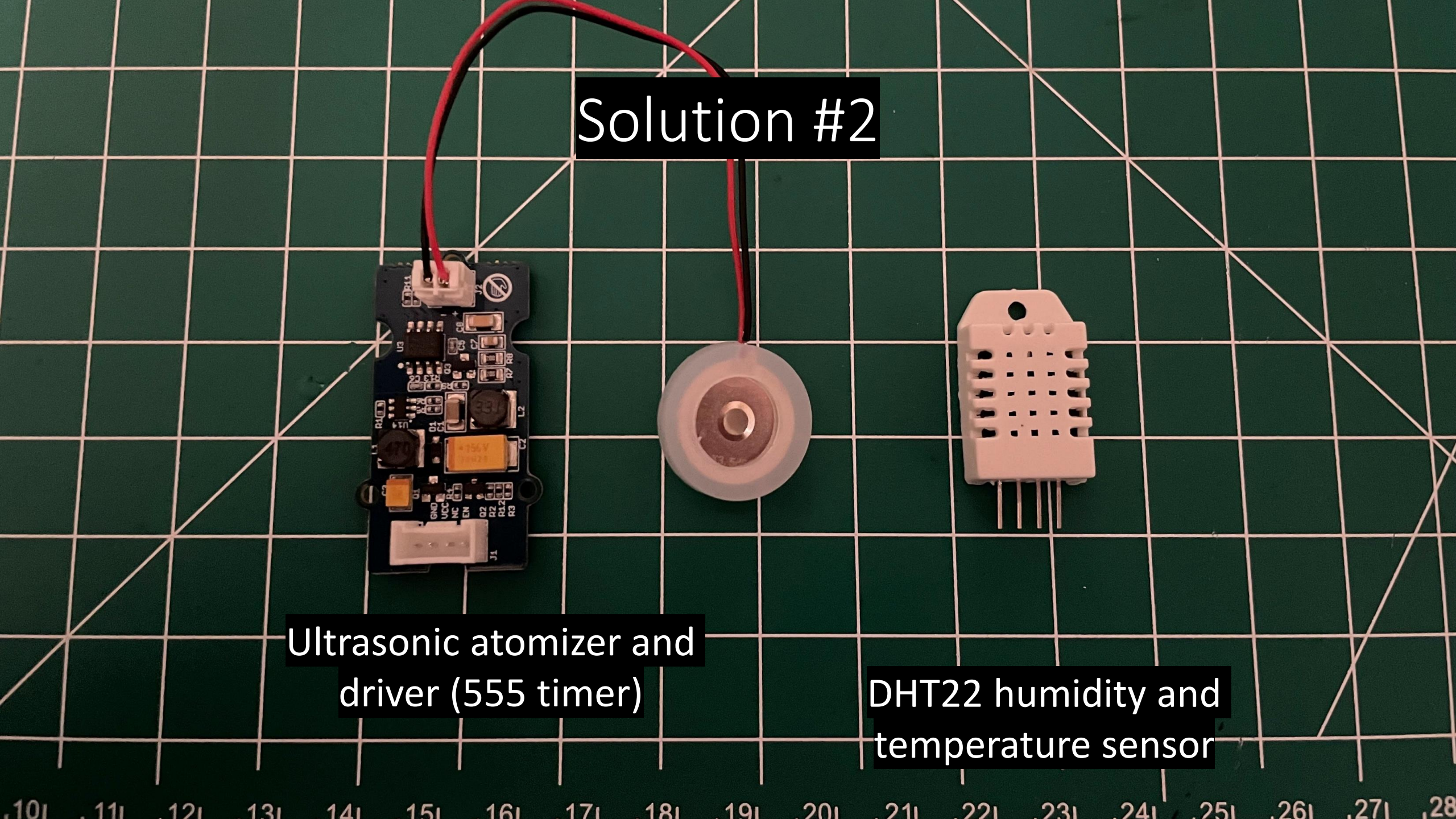
# Scalability Problem #2 : *Moisture Regulation*

- Unknowable amount of moisture will be lost during sterilization process
- Unknowable amount of moisture will be lost to fresh air exchange (FAE)

BOTTOM LINE :

Real time moisture regulation is necessary

# Solution #2



Ultrasonic atomizer and driver (555 timer)

DHT22 humidity and temperature sensor

# Scalability Problem #3 :
# *Sterilization*

## Autoclave

- Expensive ($18,000+)

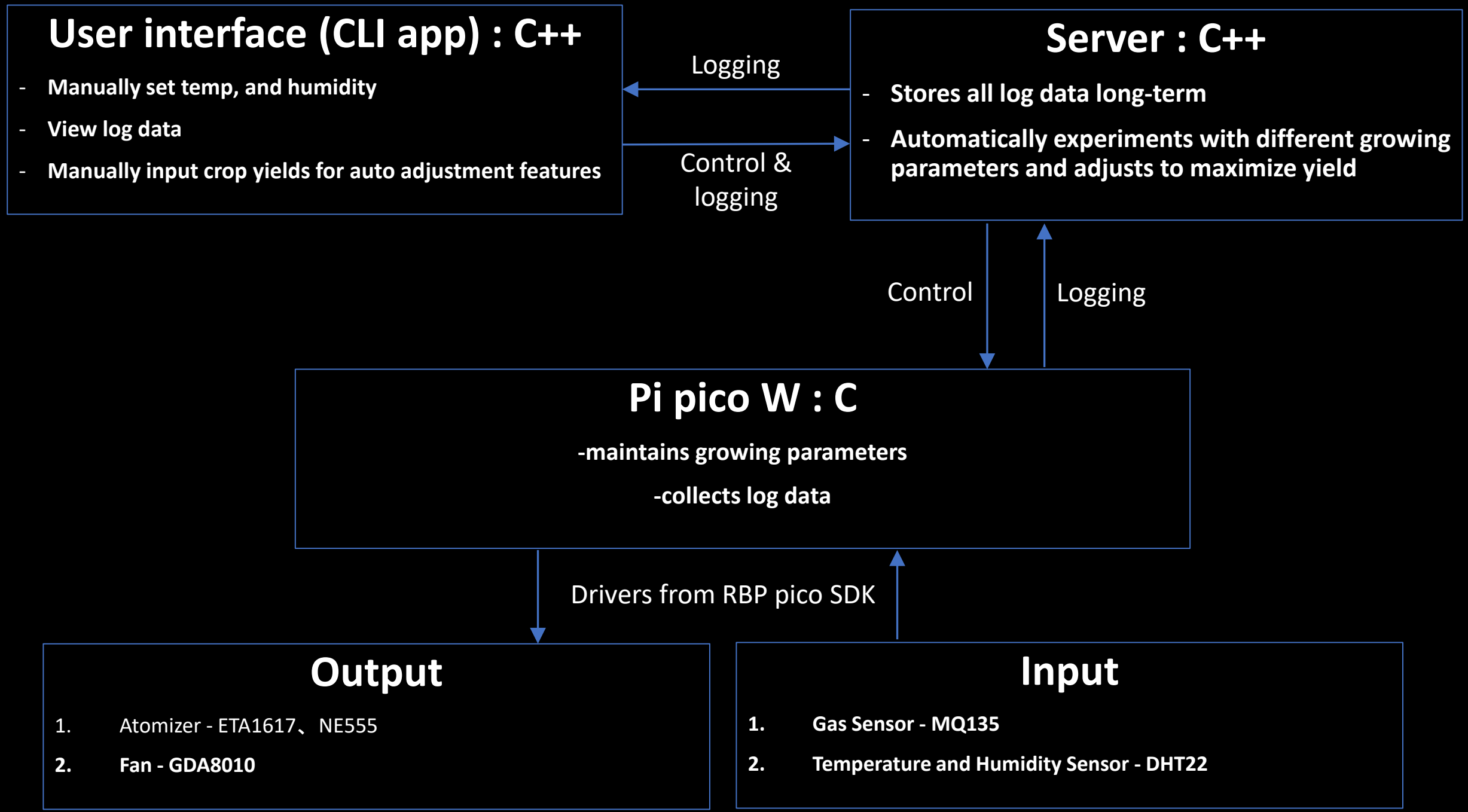

priorclave.com

## Pressure Cooker

- Inefficient
- Limits size of grow container

# Control system : RBP pico W


- Built-in wifi connectivity
- Extensive software libraries available
- Dual-core processor running at 133MHz
- 264kB RAM
- 2MB flash
- $10


User interface (CLI app) : C++
- Manually set temp, and humidity
- View log data
- Manually input crop yields for auto adjustment features
Logging
Control & logging
Server : C++
- Stores all log data long-term
- Automatically experiments with different growing parameters and adjusts to maximize yield
Control
Logging
Pi pico W : C
-maintains growing parameters
-collects log data
Drivers from RBP pico SDK
Output
1. Atomizer - ETA1617、NE555
2. Fan - GDA8010
Input
1. Gas Sensor - MQ135
2. Temperature and Humidity Sensor - DHT22

# Minimum viable product

- Working hardware prototype
- FAE control based on sensor input
- Humidity control based on sensor input
- All sensor readings logged locally on microcontroller

# Version 1.0

- Software updates over Wi-Fi
- Log data sent to server and stored there
- Command line interface with server

# Version 2.0

- WAN communication between sever and control systems
- Influence colonies’ behavior with electrical pulses (highly experimental)
- Temperature control
- Compatibility with multiple

Questions?